§44. Distribution of Divertor Temperature after Long Pulse Operation Using ICRF Heating in 9th Cycle Experiment

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Heat load on divertor plates are important for a steady state operation. Outgas from divertor plates at high heat load is one of causes of a plasma collapse. To disperse the local heat load, an operation method of magnetic axis sweep was established in the 8th cycle experiment. Temperatures on the divertor plates were saturated during the long pulse discharge so far. However, the saturated temperatures were different from the position of the plates. Distribution of divertor temperature rise was compared.

Figure 1 shows the position and the number of the divertor plates. Eight positions of divertor plate temperature are measured at each toroidal section. There are 10 toroidal sections. Figure 2 shows a time history of the ICRF power and distribution of temperature increase of the divertor plate in the longest shot of the 9th cycle experiment. Figure 3 shows the same as the Fig.2 in the other shot of the 9th cycle experiment. Different ICRF antennas were used in Fig.2 and Fig.3.

Distribution of the divertor temperature is quite different. The ICRF antennas are located at 3.5U, 3.5L, 7.5U, and 7.5L ports. In Fig.2, 3.5U, 7.5U, and 7.5L antennas were used. Temperature rise near the 7.5-port was notable. Temperatures at 6.5L, 7.5L, 6I, 7I, and 8I were especially high. Temperatures near 3.5 antennas were also relatively increased. During the long pulse discharge, sparks were observed at around the 7I port and 7.5 section. Frequency of sparks at 7I port was related to the injection power of the 7.5L antenna. Temperatures of the vacuum vessel at 7I and 9I were also high. Temperature behavior of the vacuum vessel at 7I was closely related with the ICRF power at the 7.5L antenna.

In Fig.3, 3.5U, 3.5L, and 7.5U antennas were used. The ICRF power was higher and the pulse length was shorter than that of the Fig.2 case. Temperature increase near the 7.5 antennas was relatively small. Divertor temperature at 3.5L and 3I were increased particularly. Temperature at the 2O plate was also increased. Influence of the L antennas on temperature rise of the divertor plate was larger than that of the U antennas. Watching the high temperature plates and power control of each ICRF antenna may be important for the higher power and the longer pulse operation in the future.

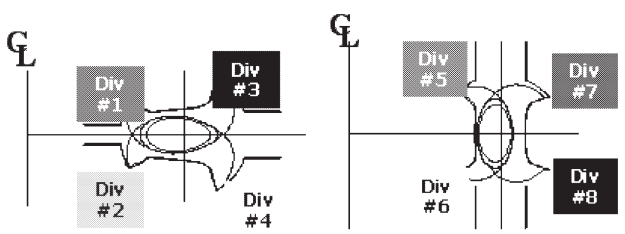

Fig. 1. Position and the number of the divertor plates.

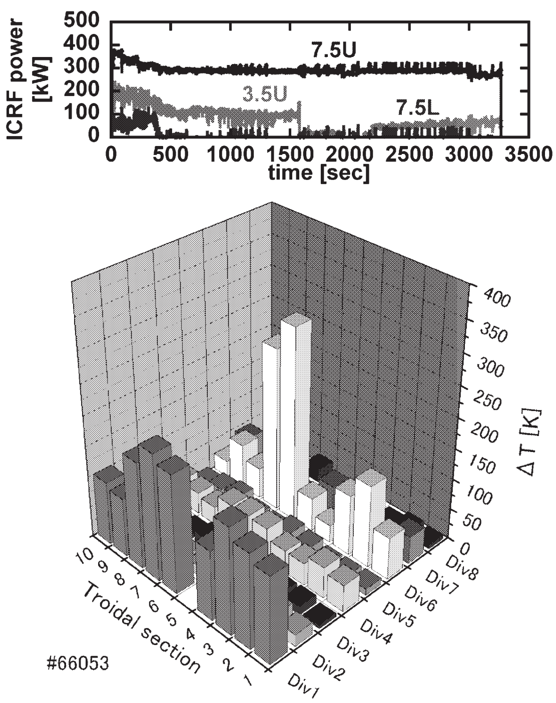

Fig. 2. Time history of the ICRF power and distribution of temperature increase of the divertor plates for the 1.6 GJ discharge.

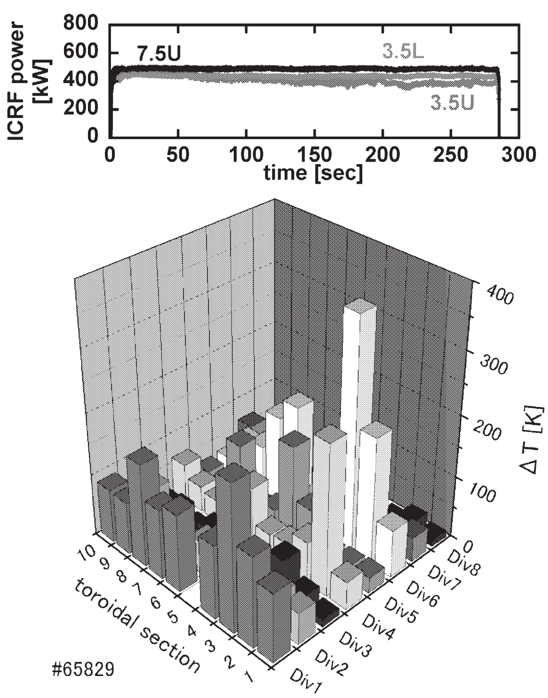

Fig. 3. Time history of the ICRF power and distribution of temperature increase of the divertor plates for the 1.35 MW injection.